

The documentation and process conversion measures necessary to comply with this revision shall be completed by 21 April 1994

INCH-POUND

MIL-S-19500/544A(USAF)
21 January 1994
SUPERSEDING
MIL-S-19500/544(USAF)
6 August 1980

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, POWER
TYPES 2N5152, 2N5154, 2N5152L, 2N5154L, JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for NPN, silicon, power transistors for use in high-speed power-switching applications. Four levels of product assurance are provided for each device type as specified in MIL-S-19500 and two levels of product assurance for die (element evaluation).

1.2 Physical dimensions. See 3.3 (TO-5, TO-39) and figures 1 and 2 (die dimensions).

1.3 Maximum ratings.

P_T 1/ $T_A = +25^\circ\text{C}$	P_T 2/ $T_C = +25^\circ\text{C}$	V_{CBO}	V_{CEO}	V_{EBO}	I_C	I_C 3/	Reverse pulse 4/ energy	Safe operating area	T_{stg} and T_J
<u>W</u>	<u>W</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>A dc</u>	<u>A dc</u>	<u>mJ</u>	See figure 3	<u>°C</u>
1	11.8	100	80	5.5	2	10	15		-65 to +200

1/ Derate linearly 5.7 mW/°C for $T_A > +25^\circ\text{C}$

2/ Derate linearly 66.7 mW/°C for $T_C > +25^\circ\text{C}$

3/ This value applies for $P_w \leq 8.3$ ms, duty cycle $\leq 1\%$

4/ This rating is based on the capability of the transistors to operate safely in the unclamped inductive load energy test circuit of figure 4.

1.4 Primary electrical characteristics at $T_C = +25^\circ\text{C}$.

Limits	h_{FE} 1/ $V_{CE} = 5$ V $I_C = 2.5$ A	$ h_{fe} $ $V_{CE} = 5$ V $I_C = 500$ mA dc $f = 10$ MHz	$V_{BE(sat)}$ 2 1/ $I_C = 5$ A dc $I_B = 500$ mA dc	$V_{CE(sat)}$ 2 1/ $I_C = 5$ A dc $I_B = 500$ mA dc	C_{obo} $V_{CB} = 10$ V dc $I_E = 0$ $f = 1$ Mhz	$R_{\theta JA}$	$R_{\theta JC}$
	2N5152 2N5154 2N5152L 2N5154L	2N5152 2N5154 2N5152L 2N5154L					
Min	30	70					
Max	90	200	2.2	1.5	250	175	15

1/ Pulsed (see 4.5.1)

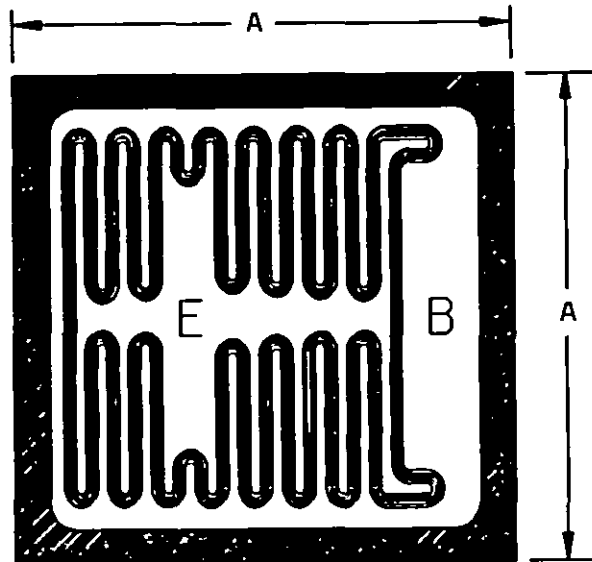
Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Electronics Supply Center, ATTN: DESC-ECT, 1507 Wilmington Pike, Dayton, OH 45444-5270, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

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FSC 5961

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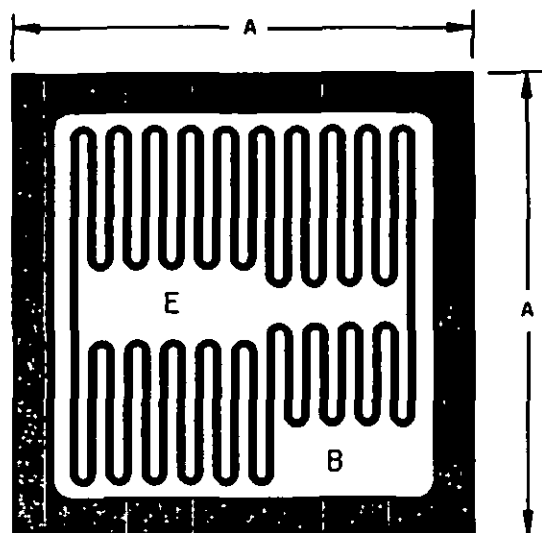
Dimensions				
Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.117	.127	2.97	3.23

NOTES:

1. Dimensions are in inches.
2. Metric equivalents (millimeters) are in parenthesis.
3. Metric equivalents are given for general information only.
4. Unless otherwise specified, tolerance is $\pm .005$ (0.13 mm).
5. The physical characteristics of the die are;
 - Thickness: .008 (0.20 mm) to .012 (0.30 mm), tolerance is $\pm .005$ (0.13 mm).
 - Top metal: Aluminum, 40,000 Å minimum, 50,000 Å nominal.
 - Back metal: Gold 2,500 Å minimum, 3,000 Å nominal.
 - Back side: Collector.
 - Bonding pad: B = .015 (0.38 mm) x .0072 (.183).
 - E = .015 (0.38 mm) x .0060 (.152).

Inches	mm
.005	0.13
.006	0.15
.0072	0.183
.008	0.20
.012	0.30
.015	0.38
.117	2.97
.127	3.23

FIGURE 1. JANHCA and JANKCA die dimensions.



Dimensions				
Ltr	Inches		Millimeters	
	Min	Max	Min	Max
A	.095	.105	2.41	2.66

NOTES:

1. Dimensions are in inches.
2. Metric equivalents (millimeters) are in parenthesis.
3. Metric equivalents are given for general information only.
4. Unless otherwise specified, tolerance is ± 0.005 (0.13 mm).
5. The physical characteristics of the die are;
 Thickness: .0078 (0.198 mm) nominal, tolerance is ± 0.005 (0.13 mm).
 Top metal: Aluminum, 25,000 Å minimum, 33,000 Å nominal.
 Back metal: Gold 1,500 Å minimum, 2,500 Å nominal.
 Back side: Collector.
 Bonding pad: .012 (0.305 mm) min. x .030 (0.761 mm) min.

Inches	mm
.005	0.13
.0078	0.198
.012	0.30
.030	0.76
.095	2.41
.105	2.66

FIGURE 2. JANHCB and JANKCB die dimensions.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

MILITARY

MIL-S-19500 - Semiconductor Devices, General Specification for.

STANDARD

MILITARY

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Unless otherwise indicated, copies of the federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Associated detail specification. The individual item requirements shall be in accordance with MIL-S-19500, and as specified herein.

3.2 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein shall be as specified in MIL-S-19500.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in figures 1 and 2 herein (JANHC and JANKC) and in MIL-S-19500 appendix F, figure 8 (T-1A (L-suffix) and T-1C (no suffix)).

3.3.1 Lead finish. Lead finish shall be in accordance with MIL-STD-750 and MIL-S-19500. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.3).

3.3.2 Current density. Current density of internal conductors shall be as specified in 3.6.5 of MIL-S-19500.

3.4 Marking. Marking shall be in accordance with MIL-S-19500.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-S-19500.

4.2.2 JANHC and JANKC devices. Qualification for shall be in accordance with appendix H of MIL-S-19500.

4.3 Screening (JANTX, JANTXV, and JANS levels only). Screening shall be in accordance with MIL-S-19500 (table II), and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table II of MIL-S-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
9	I_{CES1} and h_{FE2}	Not applicable
11	I_{CES1} and h_{FE2} ; ΔI_{CES1} = 100% of initial value or 100 nA dc, whichever is greater. Δh_{FE2} = $\pm 20\%$	I_{CES1} and h_{FE2}
12	See 4.3.1	See 4.3.1
13	Subgroup 2 of table I herein: ΔI_{CES1} = +100% of initial value or 100 nA whichever is greater Δh_{FE2} = $\pm 20\%$	Subgroup 2 of table I herein: ΔI_{CES1} = +100% of initial value or 100 nA whichever is greater Δh_{FE2} = $\pm 20\%$

4.3.1 Screening (JANC). Screening of JANC die shall be in accordance with MIL-S-19500, appendix H. As a minimum, die shall be 100-percent probed to insure compliance with group A, subgroup 2.

4.3.2 Power burn-in conditions. Power burn-in conditions are as follows: T_A = Room ambient as defined in the general requirements of MIL-STD-750, 4.5.

$$V_{CE} = 40 \text{ V} \pm 1 \text{ V} \quad P_T = 1.0 \text{ W (min)}$$

NOTE: No heat sink or forced air cooling on the device shall be permitted.

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-S-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-S-19500 and table I herein. End-point electrical measurements shall be in accordance with the applicable steps of table II herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with conditions specified for the subgroup testing in table IVa (JANS) and table IVb (JANTX and JANTXV) of MIL-S-19500 and as follows. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.

4.4.2.1 Group B inspection, table IVa (JANS) of MIL-S-19500.

Subgroup	Method	Condition
B4	1037	$P_T = 1.0 \text{ W min.}$, $V_{CB} = 40 \pm 1 \text{ V dc}$; $T_A = +25^\circ\text{C} \pm 3^\circ\text{C}$, $t_{on} = t_{off} = 3 \text{ minutes minimum for 2,000 cycles.}$
B5	1027	$V_{CB} = 20 \text{ V dc}$; $T_J = +275^\circ\text{C} \pm 5^\circ\text{C}$ for 96 hours. Adjust as required by the chosen T_A to give an average lot $T_J = +275^\circ\text{C}$. Marking legibility requirements shall not apply.
B6	3131	See 4.5.2.

4.4.2.2 Group B inspection, table IVb (JAN, JANTX, and JANTXV) of MIL-S-19500.

Subgroup	Method	Condition
B3	1027	$V_{CB} = 40 \text{ V dc}; P_T = 1 \text{ W}, T_A \approx +25^\circ\text{C}.$
B5	3131	See 4.5.2.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IV of MIL-S-19500. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.

Subgroup	Method	Condition
C2	2036	Test condition E.
C6	1026	$V_{CB} = 40 \text{ V dc}; P_T = 1 \text{ W}, T_A \approx +25^\circ\text{C}.$

4.5 Methods of examination and test. Methods of examination and test shall be as specified in the appropriate tables and as follows:

4.5.1 Pulse measurements. Conditions for pulse measurements shall be as specified in Section 4 of MIL-STD-750.

4.5.2 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with method 3131 of MIL-STD-750. The following details shall apply:

- Collector current magnitude during power application shall be 500 mA dc.
- Collector to emitter voltage magnitude shall be 10 V dc.
- Reference temperature measuring point shall be the case.
- Reference temperature measuring point shall be within the range $+25^\circ\text{C} \leq T_R \leq +35^\circ\text{C}$. The chosen reference temperature shall be recorded before the test is started.
- Mounting arrangement shall be with heat sink to case.
- Maximum limit of $R_{\theta JC}$ shall be 15.0°C/W .

4.5.3 Inspection conditions. Unless otherwise specified herein all inspections shall be conducted at a case temperature (T_C) of $+25^\circ\text{C}$.

TABLE I. Group A inspection.

Inspection 1/ 	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical inspection	2071					
<u>Subgroup 2</u>						
Breakdown voltage, collector to emitter	3011	Bias condition D, $I_C = 100 \text{ mA dc}$ $I_B = 0$ Pulsed (see 4.5.1)	$V_{(BR)CEO}$	80		V dc
Collector to emitter cutoff current	3041	Bias condition C, $V_{CE} = 60 \text{ V dc}$ $V_{BE} = 0$	I_{CES1}		1.0	$\mu\text{A dc}$
Collector to emitter cutoff current	3041	Bias condition C, $V_{CE} = 100 \text{ V dc}$ $V_{BE} = 0$	I_{CES2}		1.0	mA dc
Collector to emitter cutoff current	3041	Bias condition D, $V_{CE} = 40 \text{ V dc}$ $I_B = 0$	I_{CEO}		50	$\mu\text{A dc}$
Emitter to base cutoff current	3061	Bias condition D, $V_{EB} = 4 \text{ V dc}$ $I_C = 0$	I_{EB01}		1.0	$\mu\text{A dc}$
Emitter to base cutoff current	3061	Bias condition D, $V_{EB} = 5.5 \text{ V dc}$ $I_C = 0$	I_{EB02}		1.0	mA dc
Forward current transfer ratio	3076	$V_{CE} = 5 \text{ V dc}$ $I_C = 50 \text{ mA dc}$	h_{FE1}		20 50	
Forward - current transfer ratio	3076	$V_{CE} = 5 \text{ V dc}$ $I_C = 2.5 \text{ A dc}$ Pulsed (see 4.5.1)	h_{FE2}		30 70	90 200
Forward - current transfer ratio	3076	$V_{CE} = 5 \text{ V dc}$ $I_C = 5 \text{ A dc}$ Pulsed (see 4.5.1)	h_{FE3}		20 40	

See footnote at end of table.

TABLE I Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2 - Continued.</u>						
Base-emitter voltage (nonsaturated)	3066	Test condition B, $V_{CE} = 5 \text{ V dc}$ $I_C = 2.5 \text{ A dc}$ Pulsed (see 4.5.1)	V_{BE}		1.45	V dc
Base-emitter saturation voltage	3066	Test condition A, $I_C = 2.5 \text{ A dc}$ $I_B = 250 \text{ mA dc}$ Pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.45	V dc
Base-emitter saturation voltage	3066	Test condition A, $I_C = 5 \text{ A dc}$ $I_B = 500 \text{ mA dc}$ Pulsed (see 4.5.1)	$V_{BE(sat)2}$		2.2	V dc
Collector-emitter saturation voltage	3071	$I_C = 2.5 \text{ A dc}$ $I_B = 250 \text{ mA dc}$ Pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.75	V dc
Collector-emitter saturation voltage	3071	$I_C = 5 \text{ A dc}$ $I_B = 500 \text{ mA dc}$ Pulsed (see 4.5.1)	$V_{CE(sat)2}$		1.5	V dc
<u>Subgroup 3</u>						
High temperature operation:		$T_C = +150^\circ\text{C}$				
Collector to emitter cutoff current	3041	Bias condition A $V_{CE} = 60 \text{ V dc}$ $V_{BE} = -2 \text{ V dc}$	I_{CEX}		500	$\mu\text{A dc}$
Low temperature operation		$T_C = -55^\circ\text{C}$				
Forward - current transfer ratio	3076	$V_{CE} = 5 \text{ V dc}$ $I_C = 2.5 \text{ A dc}$ Pulsed (see 4.5.1)	h_{FE4}		15 25	
2N5152 2N5154						
<u>Subgroup 4</u>						
Common-emitter, small- signal, short-circuit, forward-current transfer ratio	3206	$V_{CE} = 5 \text{ V dc}$ $I_C = 100 \text{ mA dc}$ $f = 1 \text{ kHz}$	h_{fe}		20 50	
2N5152 2N5154						

See footnote at end of table.

TABLE I Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4 - Continued.</u>						
Magnitude of common-emitter, small-signal short-circuit, forward-current, transfer ratio	3306	$V_{CE} = 5 \text{ V dc}$ $I_C = 500 \text{ mA dc}$ $f = 10 \text{ MHz}$	$ h_{fe} $			
2N5152 2N5154				6 7		
Open-circuit output capacitance	3236	$V_{CB} = 10 \text{ V dc}$ $I_E = 0$ $f = 1 \text{ MHz}$	C_{obo}		250	pf
Switching time		$I_C = 5 \text{ A dc}$ $I_{B1} = 500 \text{ mA dc}$	t_{on}		0.5	μs
		$I_{B2} = -500 \text{ mA dc}$	t_s		1.4	μs
		$V_{BE(off)} = 3.7 \text{ V dc}$	t_f		0.5	μs
		$R_L = 6\Omega$ (See figure 5)	t_{off}		1.5	μs
<u>Subgroup 5</u>						
Safe operating area (d.c.)	3055	Pre-pulse condition for each test: $V_{CE} = 0$ $I_C = 0$ $T_C = +25^\circ\text{C}$ Pulse condition for each test $t_p = 1 \text{ sec.}$ 1 cycle $T_C = +25^\circ\text{C}$ (See figure 3)				
Test # 1		$V_{CE} = 5.8 \text{ V dc}$ $I_C = 2 \text{ A dc}$				
Test # 2		$V_{CE} = 32 \text{ V dc}$ $I_C = 340 \text{ mA dc}$				
Test # 3		$V_{CE} = 80 \text{ V dc}$ $I_C = 20 \text{ mA dc}$				

See footnote at end of table.

TABLE I Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 5 - Continued.</u>						
Safe operating area (unclamped inductive)		$T_C = +25^\circ\text{C}$ $R_{BB1} = 10\Omega$ $R_{BB2} = 100\Omega$ $L = 0.3 \text{ mH}$ $R_L = 0.1\Omega$ $V_{CC} = 10 \text{ V dc}$ $V_{BB1} = 10 \text{ V dc}$ $V_{BB2} = 4 \text{ V dc}$ $I_{CM} = 10 \text{ A dc}$ (See figure 4)				
End-point electrical measurements		See table II Steps 1, 2, and 3				
<u>Subgroups 6 and 7</u>						
Not applicable						

1/ For sampling plan, see MIL-S-19500

TABLE II. Groups B and C Electrical measurements. 1/ 2/ 3/

Steps	Inspection 4/	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Collector to emitter cutoff current	3041	$V_{CE} = 60$ V dc cond. C, $V_{BE} = 0$	I_{CES1}		1.0	μ A dc
2.	Forward - current transfer ratio 2N5152 2N5154	3076	$V_{CE} = 5$ V dc $I_C = 2.5$ A dc Pulsed (see 4.5.1)	h_{FE2}	30 70	90 200	
3.	Breakdown voltage collector to emitter	3011	Bias condition D, $I_C = 100$ mA dc $I_B = 0$ Pulsed (see 4.5.1)	$V_{(BR)CEO}$	80		V dc
4.	Collector to emitter cutoff current	3041	$V_{CE} = 60$ V dc	I_{CES1} 5/	100% of initial value or 100 nA whichever is greater		
5.	Forward - current transfer ratio	3076	$I_C = 2.5$ V dc $V_{CE} = 5$ V dc Pulsed (see 4.5.1)	Δh_{FE2} 5/	$\pm 20\%$ change from initial reading		
6.	Base to emitter saturation voltage	3066	Test condition A, $I_C = 2.5$ A dc $I_B = 250$ mA dc Pulsed (see 4.5.1)	$V_{BE(sat)}$		1.45	V dc

1/ The electrical measurements for table IVa (JANS) of MIL-S-19500 are as follows:

- a. Subgroup 3, see table II herein, steps 1, 2, and 6.
- b. Subgroups 4 and 5, see table II herein, steps 3, 4, 5, and 6.

2/ The electrical measurements for table IVb (JAN, JANTX and JANTXV) of MIL-S-19500 are as follows:

- a. Subgroup 2, see table II herein, steps 1, 2, and 3.
- b. Subgroups 3 and 6, see table II herein, steps 4, and 5.

3/ The electrical measurements for table V of MIL-S-19500 are as follows:

- a. Subgroups 2 and 3, see table II herein, steps 1, 2, and 3.
- b. Subgroup 6, see table II herein, steps 4 and 5.

4/ See MIL-S-19500 for sampling plan.

5/ Devices which exceed the group A limits for this test shall not be accepted.

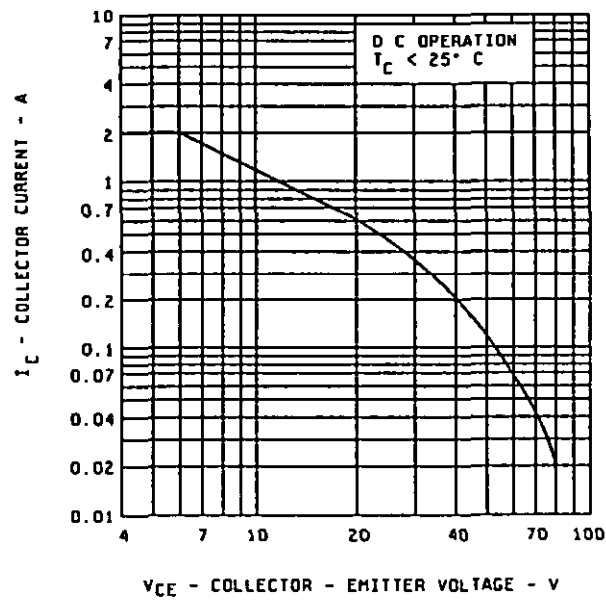


FIGURE 3. Maximum safe operating area.

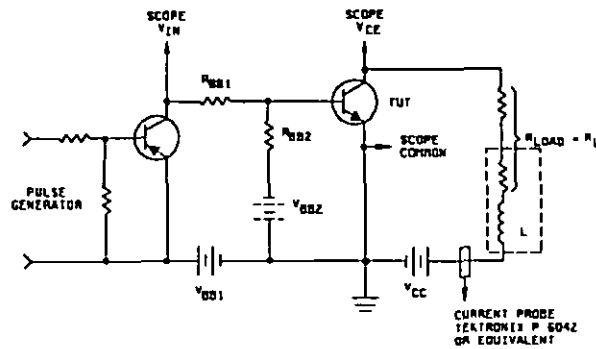
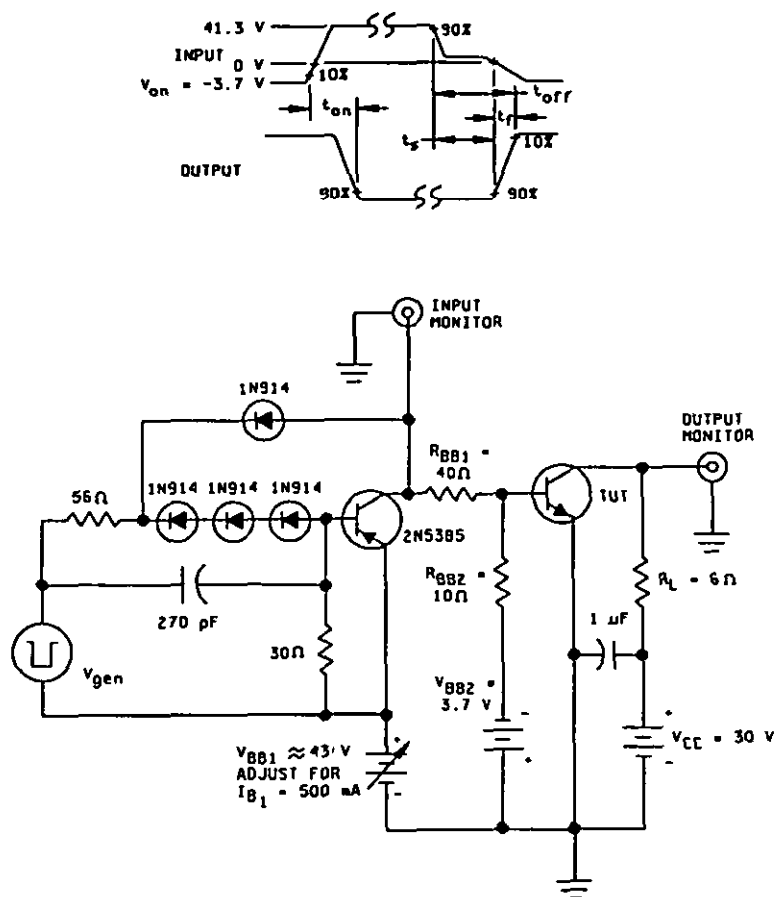
$$\begin{aligned} R_{BB1} &= 10\Omega \\ R_{BB2} &= 100\Omega \\ L &= 0.3 \text{ mH} \\ R_L &= 0.1\Omega \\ V_{CC} &= 10 \text{ V dc} \\ I_{CM} &= 10 \text{ A} \\ V_{BB1} &= 10 \text{ V dc} \\ V_{BB2} &= 4 \text{ V dc} \end{aligned}$$


FIGURE 4. Unclamped inductive load energy test circuit.



NOTES:

1. V_{gen} is a -30 pulse (from 0 V) into a 50 ohm termination.
2. The V_{gen} waveform is supplied by a generator with the following characteristics:
 $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50$ ohm, duty cycle $\leq 2\%$, $t_w = 20$ μ s.
3. Waveforms are monitored on an oscilloscope with the following characteristics:
 $t_r \leq 1$ ns, $R_{in} \geq 10$ Mohm, $C_{in} \leq 11.5$ pF.
4. Resistors must be noninductive types.
5. The dc power supplies may require additional bypassing in order to minimize ringing.
6. An equivalent drive circuit may be used

FIGURE 5. Switching time test circuit.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-S-19500.

6. NOTES

(This section contains information of a general nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-S-19500 are applicable to this specification.

6.2 Complimentary use. The devices specified herein are designed for complimentary use with the 2N5151 and 2N5153.

6.3 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of the specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).
- c. Lead finish (see 3.3.1)
- d. Product assurance level and type designator.
- e. For die acquisition, the JANHC or JANKC designation shall be as specified (see 6.4 and figures 1 and 2).

6.4 Suppliers of JANC die. The qualified JANC suppliers with the applicable letter version (example JANHCA2N5152) will be identified on the QPL.

JANC ordering information		
PIN	Manufacturer	
	33178	34156
2N5152	JANHCA2N5152	JANHCB2N5152
2N5154	JANHCA2N5154	JANHCB2N5154
2N5152	JANKCA2N5152	JANKCB2N5152
2N5154	JANKCA2N5154	JANKCB2N5152

6.6 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

CONCLUDING MATERIAL

Custodians:
Air Force - 17

Review Activities:
Air Force - 19, 85, 99
DLA - ES

Preparing Activity:
Air Force - 17

Agent:
DLA - ES

(Project 5961-F112)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-S-19500/544A(USAF)

2. DOCUMENT DATE (YYMMDD)
94/01/21

3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, POWER TYPES 2N5152, 2N5154, 2N5152L, 2N5154L, JAN, JANTX, JANTXV, JANHC, JANKC, AND JANS

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

(1) Commercial
(2) AUTOVON
(If applicable)

7. DATE SUBMITTED
(YYMMDD)

8. PREPARING ACTIVITY

a. NAME
Alan Barone

b. TELEPHONE (Include Area Code)
(1) Commercial 513-296-6048
(2) AUTOVON 986-6048

c. ADDRESS (Include Zip Code)
DESC-ECT
Dayton, OH. 45444-5270

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